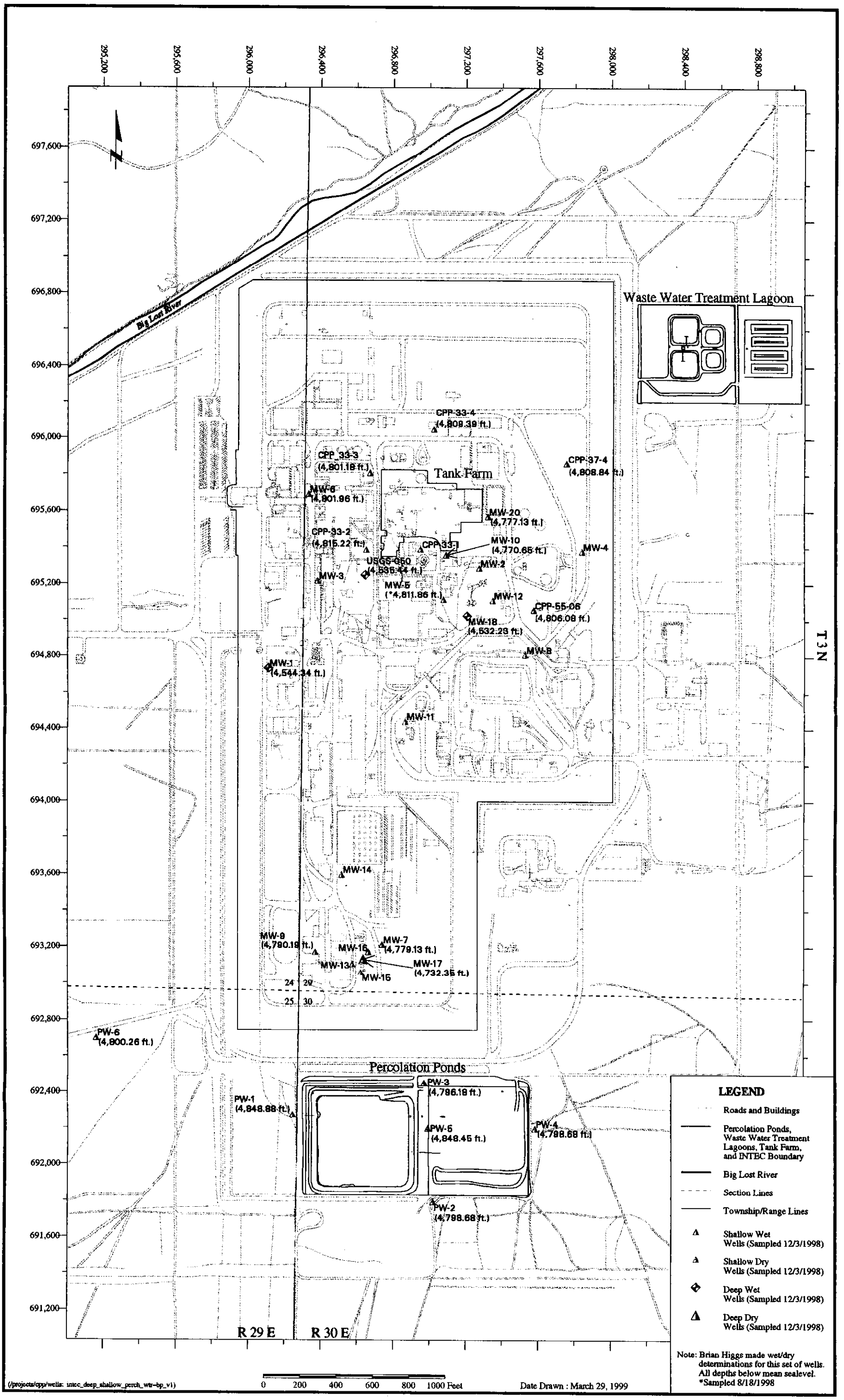

Figure 5-6. INTEC well map showing wells where perched water has been observed.

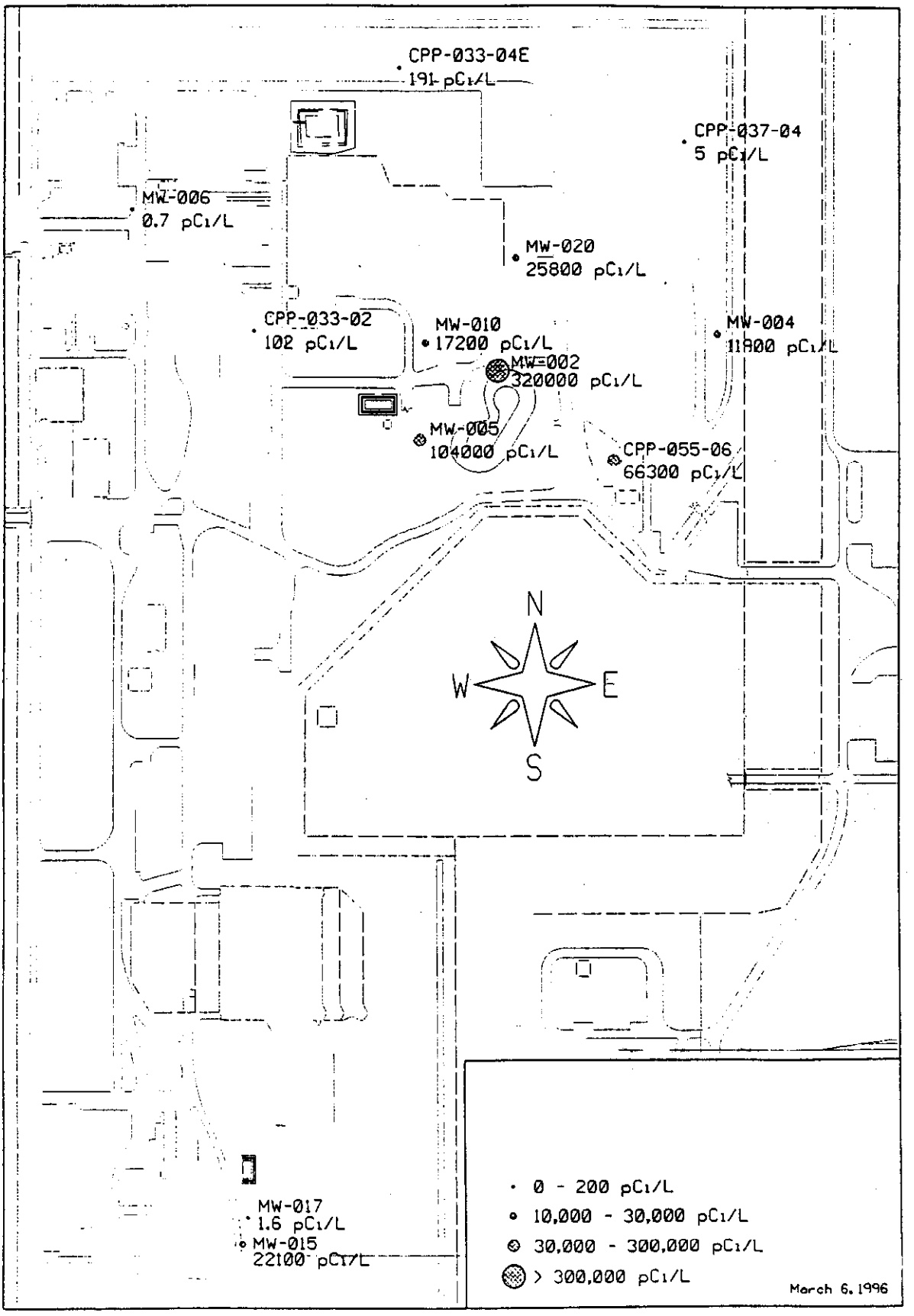

Figure 5-7. Sr-90 concentration in the upper perched groundwater (May-June 1995).

5.3.4.1 Northern Perched Groundwater. The highest perched water radioactive contamination occurs beneath the northern portion of INTEC, particularly associated with wells MW-2, MW-5, and CPP 55-06 (Figure 5-6). The maximum gross alpha and gross beta activity measured in the upper perched groundwater were 1,140±220 pCi/L and 589,000±2,600 pCi/L, respectively, in well MW-2. At a depth of approximately 42 m (140 ft), the maximum gross alpha and gross beta concentrations measured in the perched groundwater were 137±9 pCi/L and 65,300±600 pCi/L in wells MW-10 and MW-20.

The most significant radionuclides in the upper perched water body are Sr-90 and Tc-99. Low levels of H-3 were also detected in the upper perched water zone. The low H-3 concentrations in the upper perched water zone is a significant contrast to the waste stream that was directed to the INTEC disposal well where the vast majority of the associated radioactivity consisted of H-3. Strontium-90 was detected in all wells completed in the northern area of the upper perched water zone. The maximum Sr-90 concentration detected was 320,000±3,000 pCi/L (well MW-2) followed by 104,000±1,000 pCi/L (well MW-5) and 66,300±600 pCi/L (well CPP 55-06). The only other fission product detected in the upper perched groundwater is Tc-99. Tc-99 has been detected in all wells except CPP 33-4 and MW-6. The maximum Tc-99 concentration detected in the upper perched groundwater zone was 105±2 pCi/L in well MW-5.

Two wells (MW-10 and MW-20) are completed in water-bearing zones at depths of approximately 42 m (140 ft). The maximum concentrations for H-3, Sr-90, and Tc-99 from these wells are 38,000±50 pCi/L, 25,800±30 pCi/L, and 127±2 pCi/L, respectively. A comparison of the water quality from the wells completed in the upper perched groundwater body [i.e., at approximately 33 m (110 ft)] to this deeper zone indicates an increase in both H-3 and Tc-99 concentrations and a decrease in the Sr-90 concentrations.

5.3.4.2 Southern Perched Groundwater. Perched water has been identified beneath two areas of the southern INTEC. A small perched water body has been identified in the vicinity of building CPP-603 and a larger perched water body has developed from the discharge of waste water to the percolation ponds.

Wells that monitor the groundwater quality in the upper perched groundwater zone around CPP-603 include MW-7, MW-9, MW-13, MW-14, MW-15, MW-16, and MW-17. From the inorganic analysis, only nitrate/nitrite was detected at a concentration exceeding the MCL at well MW-15 (14.7 mg/L). The radionuclides detected in the groundwater include H-3 (3,360±176 to 25,700±400 pCi/L) and Tc-99 (6.4±0.6 to 23.7±0.6 pCi/L). In addition, Sr-90 and U-234 were detected in MW-15 at concentrations of 17,200±200 pCi/L and 11.8±1 pCi/L, respectively.

Perched groundwater in the percolation pond area is monitored by six wells, designated as PW-1 through PW-6, which monitor the upper-most perched groundwater body associated with waste water discharge to the percolation ponds. These wells have been monitored by the USGS since 1987. Wells PW-1, PW-2, PW-4, and PW-5 have been sampled on a quarterly basis as part of the INTEC groundwater monitoring program since 1991 (LITCO 1995c).

The waste stream to the percolation ponds is virtually the same as the waste stream formerly sent to the disposal well. Most of the historical radioactivity present in the PW-series wells is from H-3, with Sr-90 providing a secondary activity contribution. According to the USGS monitoring, activities from both H-3 and Sr-90 have remained relatively stable with the exception of an increased H-3 activity period in mid-1988. These data are presented in Figure 4-9 of the OU 3-13 RI (DOE-ID 1997b).

Constituents detected in the upper perched water zone in the vicinity of the percolation ponds that exceeded either a Federal primary or secondary MCL include chloride, nitrate, manganese, iron, and Sr-90. Chloride concentrations generally exceeded the Federal secondary MCL of 250 mg/L in all wells. Nitrate concentrations exceeded the federal primary MCL of 10 mg/L in a single sample collected from well PW-4 (14.1J mg/L from the October 1993 sample). Manganese concentrations exceeded the Federal secondary MCL of 50 μg/L in two samples collected from well PW-2 (165 μg/L from the October 1991 sample and 60.2 μg/L from the August 1993 sample). Iron concentrations exceeded the federal secondary MCL of 300 μg/L in one sample collected from PW-1 (324J μg/L from the April 1993 sample) and the first three samples collected from PW-2 (i.e., prior to September 1992). Strontium-90 concentrations exceeded the Federal primary MCL of 8 pCi/L in samples collected from PW-1, PW-4, and PW-5 with the maximum concentration measured during October 1991 sampling event at PW-1 (15.7 pCi/L).

5.3.4.3 Deep Perched Groundwater. Contamination in the lower portion of the vadose zone is different in composition from the upper perched zone. The lower vadose zone perched water contamination results from two events during which the INTEC injection well (CPP-23) collapsed and service wastewater was released into the vadose zone above the lower sediment units. The lower vadose zone contamination includes Cs-137, Sr-90, plutonium, I-129 and mercury. Deep perched groundwater is monitored at the INTEC by wells MW-1, MW-17, MW-18, and USGS-50 that are completed in water-bearing zones occurring at depths between 99.4 to 102.4 m (326 to 336 ft), 109.7 to 116.1 m (360 to 381 ft), 120.1 to 126.2 m (394 to 414 ft), and 109.7 to 123.4 m (360 to 405 ft), respectively. Historically, two rounds of groundwater samples have been collected from MW-1, one round of groundwater samples have been collected from MW-17 and MW-18, and a substantial database concerning radioactive contaminants is available for the water quality from USGS-50. Results from these water sampling events are described in the WAG 3 RI/FS Work Plan (LITCO 1995c).

Well MW-1 is located in the northern INTEC. The only chemical contaminant to exceed either a Federal primary or secondary MCL was nitrate/nitrite at a concentration of 69.6 mg/L. The radionuclides detected in water samples from well MW-1 include Sr-90 (4.5±0.4 pCi/L) and H-3 (24,700±400 pCi/L). Of these contaminants, only H-3 was measured above the Federal primary MCL of 20,000 pCi/L. Since H-3 concentrations in the deep perched water zone are higher than the H-3 concentrations in the overlying perched water bodies, the source of this contamination is either from a historical release where the contaminants have moved through the system or waste water disposal to the ICPP injection well.

Well MW-18 is completed in the deeper perched water zone near the eastern boundary of the INTEC. From the June 1995 sampling event, only nitrate/nitrite concentration at 34.4 mg/L exceeded either a Federal primary or secondary MCL. The radionuclides detected in the deep perched groundwater at this location include H-3 (73,000±700 pCi/L), Sr-90 (207±2 pCi/L), and Tc-99 (736±6J pCi/L). The H-3 and Tc-99 concentrations from this well are some of the highest concentrations measured in the perched groundwater beneath the ICPP.

USGS-50 was originally intended to be completed in the aquifer, but was ultimately drilled to a total depth of 123 m (405 ft) to monitor a deep perched water zone. This well is located in the north central portion of the facility. The highest concentrations of H-3 and Sr-90 occurred in 1969 and 1970. These elevated concentrations were attributed to the failure of the ICPP disposal well where the waste water was injected into the vadose zone rather than directly to the aquifer. Based on the response observed in well USGS-50 and the ICPP disposal well records, it appears the injection well failed in mid-1967 and allowed approximately 3.41×10^9 L (9.0×10^8 gal) of waste water to be injected into the basalt above the 69-m (226-ft) plug (Robertson et al. 1974). The ICPP disposal well was repaired by early 1971. It again failed in the 1970s and was repaired in 1982.

From the May 1995 water sampling of USGS-50, the concentrations of all chemical contaminants except nitrate/nitrite were below Federal primary or secondary MCLs. Nitrate/nitrite concentration was measured at 31.3 mg/L, compared to the Federal primary MCL of 10 mg/L. Radionuclides in the groundwater that were detected include H-3 (61,900±700 pCi/L), Sr-90 (151±2 pCi/L), and Tc-99 (63±1J pCi/L). The concentrations for H-3 and Sr-90 are within the expected values based on the historical sampling conducted by the USGS.

Well MW-17 is the only deep perched water monitoring well located in the southern portion of the INTEC. This well has been constructed to monitor three perched water bodies: an upper zone from 55.4 to 58.4 m (181.7 to 191.7 ft) bls, a middle zone from 80.4 to 83.5 m (263.8 to 273.8 ft) bls, and a lower zone from 110 to 116 m (360 to 381 ft) bls. During the May 1995 sampling event, water was only present in the upper and lower zones. None of the chemical constituents detected in the groundwater exceeded either a Federal primary or secondary MCL. Only two radionuclides (H-3 and Tc-99) were detected in groundwater samples collected from MW-17. The concentrations of these two radionuclides were similar between the upper and lower perched water zones. H-3 concentrations varied from 25,100±400 to 25,700±400 pCi/L and Tc-99 concentrations varied from 5.9±0.6 to 6.4±0.6 pCi/L.

5.3.5 Snake River Plain Aquifer (Group 5)

The water quality in the SRPA at and downgradient from the ICPP has been adversely impacted due to past facility operations. The SRPA (Group 5) is identified as containing low-level threat wastes. The majority of INTEC-related SRPA contamination is due to the disposal of wastes through the ICPP injection well. Contamination in the aquifer is also due to downward migration of contaminants from surface soils and perched groundwater zones. The injection well was the primary source for waste disposal from 1952 through February 1984 and used intermittently for emergency situations until 1986. The average discharge to the well during this period was approximately 1.4 B L/yr (363 M gal/yr) or about 3.8 M L/day (1 M gal/day) (DOE-ID 1997b). It has been estimated a total of 22,000 Ci of radioactive contaminants have been released in 4.2×10^{10} L (1.1×10^{10} gal) of water (WINCO 1994c). Table 5-25 is a summary of the total curies discharged to the injection well for each radionuclide and includes the curies remaining after radioactive decay (DOE-ID 1997b). The vast majority of this radioactivity is attributed to H-3 (approximately 96%) with minor components of Am-241, Tc-99, Sr-90, Cs-137, Co-60, I-129, and Pu. The remedy selection for the SRPA was based on groundwater transport modeling used to predict the activities/concentrations of contaminants in groundwater at the time of exposure (post 2095). This section presents data on the current water quality in the SRPA.

Since the 1950's, the USGS has installed 33 monitoring wells around the ICPP to characterize the occurrence, movement, and quality of the water in the SRPA. The location of the wells completed in the SRPA and the frequency of groundwater sample collection by the USGS are provided in Figure 4-12 of the OU 3-13 RI (DOE-ID 1997b). The ICPP has a groundwater sampling program of selected SRPA wells to satisfy the groundwater monitoring requirements for the RCRA and DOE Order 5400.1. This sampling program, implemented in October 1991, uses selected USGS wells and collects samples on a quarterly basis to be analyzed for the RCRA groundwater contamination parameters, RCRA drinking water parameters, RCRA groundwater quality parameters, and selected radionuclides. The results from this sampling program are provided in the WAG 3 RI/FS Work Plan (LITCO 1995c).

In May and June 1995, a complete round of groundwater samples were collected from the aquifer wells located near and downgradient from the ICPP (Figure 5-8). The results from this sampling effort are provided in Table 5-26. The aquifer data summarized in the RI are discussed in the following paragraphs. An isopleth map of 1995 I-129 concentrations is shown in Figure 1-7 to identify the extent of Group 5. A map of the 1995 Tritium plume is shown in Figure 5-4 and the Sr-90 plume is shown in Figure 5-5.

Table 5-25. Activity of radionuclides discharged to the ICPP injection well (RWMIS Database).

Radionuclide	Half Life (years)	Total Activity Injected (Ci)	Total Activity Remaining* (Ci)	Percent of the Injected Activity Remaining (after decay)	Percent of the Current Activity
Ag-110m	6.80E-01	8.36E-05	1.34E-12	0.0	0.00
Am-241	4.32E+02	3.17E-04	3.08E-04	97.2	0.00
Ba-140	3.49E-02	5.05E-04	8.86E-156	0.0	0.00
C-14	5.73E+03	1.27E-01	1.27E-01	99.8	0.00
Ce-141	8.90E-02	1.68E-04	3.19E-61	0.0	0.00
Ce-141/144	7.80E-01	1.16E-01	2.42E-14	0.0	0.00
Ce-144	7.80E-01	1.75E+01	2.07E-06	0.0	0.00
Co-57	7.40E-01	6.54E-03	8.91E-09	0.0	0.00
Co-60	5.27E+00	1.49E-01	8.77E-03	5.9	0.00
Cr-51	7.59E-02	5.37E-03	2.91E-67	0.0	0.00
Cs-134	2.06E+00	1.50E+00	2.03E-03	0.1	0.00
Cs-137	3.02E+01	2.05E+01	1.19E+01	57.8	0.30
Cs-138	6.10E-05	2.50E-01	0.00E+00	0.0	0.00
Eu-152	1.36E+01	8.12E-02	4.36E-02	53.7	0.00
Eu-154	8.80E+00	8.38E-02	2.95E-02	35.2	0.00
Eu-155	4.96E+00	2.22E-02	3.43E-03	15.5	0.00
H-3	1.23E+01	2.13E+04	3.89E+03	18.2	99.44
Hg-203	1.28E-01	7.33E-05	3.10E-42	0.0	0.00
I-129	1.57E+07	2.78E-01	2.78E-01	100.0	0.01
I-130	2.21E-02	2.98E+01	4.38E-152	0.0	0.00
K-40	1.28E+09	2.81E-12	2.81E-12	100.0	0.00
La-140	4.60E-03	6.22E-04	0.00E+00	0.0	0.00
Mn-54	8.80E-01	6.55E-03	7.02E-08	0.0	0.00
Nb-95	9.58E-02	4.63E-01	4.17E-35	0.0	0.00
Np-237	2.14E+06	5.48E-03	5.48E-03	100.0	0.00
Pr-144	3.29E-05	4.47E-01	0.00E+00	0.0	0.00
Pu-238	8.78E+01	1.32E-01	1.15E-01	87.1	0.00
Pu-239	2.44E+04	1.05E-02	1.04E-02	99.9	0.00
Pu-239/240	2.44E+04	3.74E-02	3.74E-02	99.9	0.00
Pu-240	6.57E+03	1.14E-03	1.14E-03	99.8	0.00
Rb-106	9.48E-07	4.81E+00	0.00E+00	0.0	0.00
Ru-103	1.10E-01	1.45E-01	4.59E-37	0.0	0.00
Ru-106	1.00E+00	1.70E+01	6.85E-04	0.0	0.00
Sb-124	1.65E-01	2.41E-04	5.02E-36	0.0	0.00
Sb-125	2.77E+00	1.86E+00	1.22E-02	0.7	0.00
Sr-85	1.78E-01	9.14E-05	1.78E-23	0.0	0.00
Sr-89	1.40E-01	5.59E+00	4.51E-27	0.0	0.00
Sr-89/90	2.86E+01	1.31E+00	6.40E-01	48.8	0.02
Sr-90	2.86E+01	1.60E+01	8.75E+00	54.8	0.22
U-234	2.45E+05	2.28E-02	2.28E-02	100.0	0.00
U-235	7.04E+08	1.94E-03	1.94E-03	100.0	0.00
U-236	2.34E+07	4.09E-04	4.09E-04	100.0	0.00
U-238	4.47E+09	6.81E-03	6.81E-03	100.0	0.00
Y-90	7.32E-03	1.32E+00	0.00E+00	0.0	0.00
Zn-65	6.68E-01	4.65E-04	1.39E-11	0.0	0.00
Zr-95	1.78E-01	2.34E-01	2.53E-23	0.0	0.00
Zr/Nb-95	1.78E-01	2.06E+01	1.38E-43	0.0	0.00
Unidentified Alpha	–	6.36E-01	–	–	–
Unidentified Beta-Gamma	–	5.82E+01	–	–	–
Others**		6.33E+02	–	–	–
	Total	2.22E+04	3.92E+03	–	100.0

* Decayed to January 1, 1995

** Estimate of radionuclides other than H-3 from 1957 to 1962 [assuming 95.5% of the total curies is H-3, Barraclough (1966)]

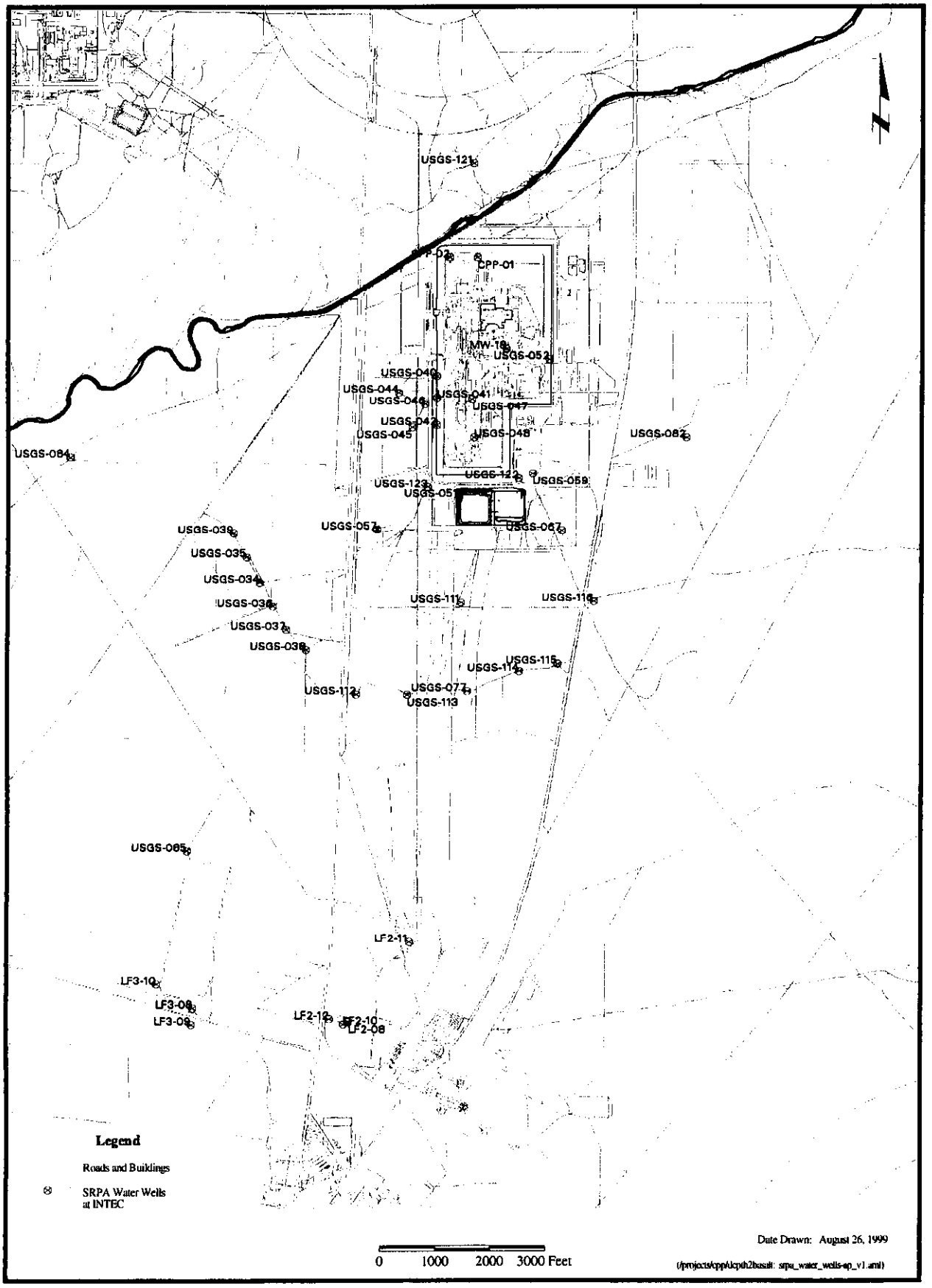

Figure 5-8. SRPA sampling wells location map.

Table 5-26. Summary sampling results statistics for contaminants in the SRPA Wells (May-June 1995).[a]

Contaminants	Water concentration, mg/L or pCi/L					
	Minimum	Maximum	PRG[b]	Number of Samples	Number of Detects	Frequency of Detection
Ag	6.30E-04 BNJ	8.80E-04 BNJ	1E-01[c]	38	3	8%
As	3.10E-03 B	1.08E-02 B	5E-02	42	3	7%
Ba	5.00E-02 B	2.05E-01	2E+00	42	42	100%
Cd	4.80E-04 B	3.00E-03 B	5E-03	42	4	10%
Co	5.20E-04 B	1.40E-03 B	NA	42	8	19%
Cr	1.80E-03 B	3.88E-02	1E-01	42	31	74%
Cu	1.60E-03 BJ	3.20E-03 B	1.3E+00	42	7	17%
Hg	1.00E-04 B	4.40E-04	2E-03	42	7	17%
Mn	8.40E-04 B	6.28E-02	5E-02[c]	42	10	24%
Ni	4.30E-03 B	2.06E-01	NA	42	6	14%
Pb	2.30E-03 BWJ	3.77E-02	1.5E-02	42	10	24%
Sb	1.90E-03 B	4.60E-03 B	6E-03	42	3	7%
Se	1.40E-03 B	3.70E-03 B	5E-02	42	7	17%
V	2.30E-03 B	9.90E-03 B	NA	42	24	57%
Zn	2.60E-03 B	4.54E-01 EJ	5E+00[c]	42	27	64%
Am-241	5.40E-01	5.40E-01	<1.5E+01[d]	49	1	2%
I-129[e]	9E-07	3.82E+00	1E+00[d]	33	32	94%
Sr-90	7.00E-01	8.40E+01	8E+00	70	49	70%
Tc-99	1.10E+00	4.48E+02	9E+02[d]	70	57	81%
Tritium	5.81E+02	3.07E+04	2E+04	49	45	92%
U-234	7.00E-01	2.60E+00	1.5E+01[f]	49	7	14%
U-238	8.00E-01	1.10E+00	1.5E+01[f]	49	4	8%

Table 5-26. (continued).

Contaminants	Water concentration, mg/L or pCi/L Minimum	Maximum	PRG[b]	Number of Samples	Number of Detects	Frequency of Detection
Gross Alpha	2.30E+00	1.00E+01	1.5E+01[g]	49	20	41%
Gross Beta	2.40E+00	4.69E+02	4mR/yr[h]	49	49	100%

a. NOTE:

- Duplicate and QC sample results were not included in the statistical analysis.
- Analytical results are from groundwater samples collected from the SRPA during May and June 1995 as part of the OU 3-13 RI. Results are provided in Table 4-4 of the OU3-13 RI/FS Part A (DOE-ID 1997b) and the ERIS Database.
- Samples were analyzed for TAL inorganics and radionuclides. Only those constituents that were identified above detection limits in the samples are shown in the table except for the following constituents which were detected but are not considered to be present at hazardous concentrations: Ca, Fe, Mg, K, and Na.
- Samples rejected because of an unacceptable quality control parameter were not included in the table.

b. The PRG concentrations are from the Primary Constituent Standards table in IDAPA 16.01.11.200(a) unless otherwise footnoted.

c. The PRG concentrations for manganese, silver, and zinc are from the Secondary Constituent Standards in IDAPA 16.01.11.200 (b).

d. The PRG concentrations for Am-241, I-129, and Tc-99 are calculated values based on the National Interim Primary Drinking Water Regulations, EPA-570/9-76-003.

e. Summary sampling data for I-129 was taken from data collected during the 1990-91 USGS sampling event (USGS 1994). The data shown in the table is only from those wells sampled both during the 1990-91 USGS sampling event and the WAG 3 RI/FS, May-June 1995, sampling event.

f. The PRG concentrations for U-234 and U-238 are from Section 8, Table 8-2 of this ROD.

g. The PRG concentration for gross alpha includes radium-226 but excludes radon and uranium.

h. The PRG concentration for gross beta (combined beta/photon emitters) is 4 mR/yr effective dose equivalent.

B = Contaminant in associated blank.

E = The reported value is estimated because of the presence of interference.

J = Estimated concentration.

N = Spiked sample recovery was not within control limits.

W = Post-digestion spike for GFAAS analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.

NA = Not applicable.

PRG = Preliminary Remediation Goal.

5.3.5.1 Cesium-137. According to Bartholomay (1997), Cs-137 has been detected above reporting levels through 1985 in wells USGS-40 and USGS-47 at the ICPP due to liquid-waste discharge to the ICPP injection well. During 1982 to 1985, maximum concentrations in wells USGS-40 and USGS-47 were 237±45 and 200±50 pCi/L, respectively. During 1986 to 1988, Cs-137 was not detected in these wells (Orr and Cecil 1991). Since 1988, cesium-137 was detected in one sample from well USGS-40 (70±30 pCi/L on January 15, 1990) and one sample from well USGS-47 (70±30 pCi/L on April 29, 1992). Cs-137 was not detected in any of the aquifer wells sampled during the WAG 3 RI. The half-life for Cs-137 is 30.17 yrs.

5.3.5.2 Plutonium. Monitoring the quantities of Pu-238 and Pu-239/-240 (undivided) discharged to the ICPP disposal well began in 1974. Prior to that time, alpha activity from plutonium disintegration was not separable from the monitored, undifferentiated alpha activity. During 1974 through 1985, about 0.15 Ci of Pu-238 and 0.05 Ci of Pu-239/-240 (undivided) were discharged to the ICPP injection well. During the period from 1986 to 1988, approximately 0.06 Ci of plutonium isotopes were discharged to the infiltration ponds at the ICPP. The half-lives of Pu-238, -239, and -240 are 87.7, 24, 100, and 6,560 years, respectively.

According to Orr and Cecil (1991), plutonium has been detected in the SRPA near the ICPP in wells USGS-40 and USGS-47. Both of these wells are located near the ICPP injection well. In well USGS-40, Pu-238 and Pu-239/-240 (undivided) were last detected in January 1987 at concentrations of 0.47±0.16 pCi/L and 5.5±0.4 pCi/L, respectively. In well USGS-47, Pu-238 was last detected in October 1983 at a concentration of 0.5±0.06 pCi/L. Since the 1986 to 1988 period reported by Orr and Cecil (1991).

Pu-238 was only detected in a single water sample collected from well USGS-48. The sample was collected in October 1990 and had a concentration near the MDL at 0.05±0.02 pCi/L. Between 1992 and 1995, all plutonium measurements at the INEEL were below the reporting level (Bartholomay 1997). Plutonium was not detected in any of the aquifer wells sampled during the WAG 3 RI field investigation of 1995.

5.3.5.3 Americium-241. Americium-241 is a decay product of Pu-241 and has a half-life of 432.7 years. According to Orr and Cecil (1991), Am-241 has only been detected in the SRPA near the RWMC and TAN. Since 1988, however, Am-241 was detected in well USGS-44 during July 1992 at concentrations of 0.07±0.03 and 0.08±0.03 pCi/L, in well USGS-37 during October 1992 at a concentration of 0.09±0.03 pCi/L, and in well USGS-85 during June 1991 at concentrations of 0.08±0.03 pCi/L. During 1992-1995, all other plutonium measurements were below the reporting level (Bartholomay 1997). During the WAG 3 RI field investigation in 1995, Am-241 was detected in well USGS-42 at a concentration of 0.54±0.14 pCi/L.

5.3.5.4 Iodine-129. From 1953 to 1983, an estimated 0.01 to 0.136 Ci/yr (0.56 to 1.18 Ci) of I-129 were contained in the wastewater discharged to the disposal well (Mann et al. 1988). For 1984 to 1986, the annual amount of I-129 in the wastewater discharged to the ICPP percolation ponds ranged from 0.0064 to 0.039 Ci.

Four rounds of groundwater samples (1977, 1981, 1986, 1990, and 1991) have been collected by the USGS from the SRPA at the ICPP (Mann and Beasley 1994). According to Mann and Beasley (1994), "In 1990 and 1991 concentrations of I-129 in water samples from wells that obtain water from the Snake River Plain aquifer ranged from 6.00E-7±2.00E-7 to 3.82±0.19 pCi/L. The mean concentration in water from 18 wells was 0.81±0.19 as compared to 1.3±0.26 in 1986." Mann et al. (1988) reported a

similar decrease in I-129 groundwater concentrations between the 1981 and 1986 sampling events. The distribution of I-129 in the SRPA for 1990-91 is provided in Figure 1-7.

During the WAG 3 RI, I-129 was detected in wells USGS-67, LF2-12, and LF3-08 at concentrations of 1±0.3 pCi/L, 1.2±0.3 pCi/L, and 0.9±0.3 pCi/L, respectively. Two of these wells are located several miles downgradient from the ICPP. The limited amount of I-129 contamination in the aquifer is consistent with the observations made by Mann et al. (1988) where decreasing I-129 concentrations were attributed to decreasing I-129 disposal and the change in disposal techniques. The half-life of I-129 is 1.57E+07 years.

5.3.5.5 Tritium. A H-3 plume has developed in the SRPA from disposal of liquid wastes at the INEL. The principle sources of H-3 in the aquifer have been through injection of liquid wastes through the disposal well at the ICPP and discharge of waste water to the infiltration ponds at the ICPP and the TRA. It is estimated approximately 30,900 Ci of H-3 have been discharged to the SRPA at the ICPP since 1952 (Orr and Cecil 1991). Of this amount, approximately 22,200 Ci were discharged via the disposal well at the ICPP. The remainder of the H-3 was discharged to the aquifer via the ICPP percolation ponds.

According to Orr and Cecil (Page 30, 1991), "Tritium concentrations in water from the Snake River Plain aquifer decreased by as much as 39,000 pCi/L during 1986-1988. By October 1988, tritium concentrations ranged from 700±200 pCi/L to 61,600±1,100 pCi/L and the tritium plume extended southwestward in the general direction of ground-water flow. The size of the plume in which tritium concentrations exceeded 500 pCi/L decreased from about 51 mi^2 in October 1985 to about 45 mi^2 in October 1988. The area of the plume containing tritium concentrations in excess of the MCL of 20,000 pCi/L (EPA 1989, p. 551) decreased from 4.4 to 2.8 mi^2.' The reduced concentrations of H-3 were attributed to radioactive decay processes, overall reduction in H-3 disposal rates, dilution from recharge, and changes in the disposal methods

The distribution of H-3 in the SRPA for May 1995 is shown in Figure 5-4. The size of the plume that exceeds the federal drinking water standard of 20,000 pCi/L is approximately 3.3 km^2 (1.3 mi^2), significantly smaller than the 7.3 km^2 (2.8 mi^2) reported in October 1988.

5.3.5.6 Strontium-90. A plume of Sr-90 has formed downgradient from the ICPP primarily in response to the ICPP disposal well. According to Orr and Cecil (page 32, 1991), "in October 1985, the size of the strontium-90 plume where concentration exceeded 6 pCi/L was about 2 mi^2 (Pittman et al. 1988, p. 53); the concentrations of strontium-90 in wells 57 and 47 were 74±5 and 63±5 pCi/L, respectively. Strontium concentrations decreased as much as 33 pCi/L during 1986-1988. By October 1988, strontium-90 concentrations ranged from 8±2 to 48±3 pCi/L, and the area of the strontium-90 plume had decreased to approximately 0.8 mi^2. The strontium-90 concentrations in wells 57 and 47, both within the plume, decreased to 41±3 and 48±3 pCi/L, respectively." They attributed the reduced areal extent and concentration of Sr-90 to the diversion of liquid radioactive wastes from the disposal well to the infiltration ponds in addition to radioactive decay, diffusion, dispersion, and dilution from natural recharge. Since 1989, concentrations of Sr-90 in water samples from most wells have remained relatively constant.

The distribution of Sr-90 in the SRPA for May 1995 is provided in Figure 5-5. The areal extent of the Sr-90 plume has decreased between October 1988 and May 1995, consistent with the previous trend. The maximum Sr-90 concentration detected in the aquifer was 84 pCi/L in well MW-18. Historical Sr-90 concentrations for the USGS and CPP aquifer wells were provided in the WAG 3 RI/FS Work Plan (LITCO 1995c).

5.3.5.7 Technetium-99. Tc-99 was identified in 32 of the 44 wells sampled during the WAG 3 RI. The highest concentrations of Tc-99 were identified in the north central portion of the ICPP in wells MW-18, USGS-47, and USGS-52 having concentrations of 448±4 pCi/L, 235±3 pCi/L, and 174±2 pCi/L, respectively. The Tc-99 plume extends to the southwest of the ICPP and includes wells USGS-123, USGS-57, and USGS-39. The maximum Tc-99 concentration outside the ICPP security perimeter fence is 49 pCi/L in well USGS-123.

Chemical constituents detected in SRPA at the INEEL have in the past included total chromium, sodium, chloride, and nitrate. During the WAG 3 RI, water samples were collected from all aquifer wells and analyzed for CLP metals plus zirconium. From the 44 wells tested, only the water sample from well LF2-11 exceeded a federal primary or secondary MCL. The magnesium concentration in LF2-11 was measured at 62.8 μg/L, compared to a federal secondary MCL of 50 μg/L. This well is located approximately three miles downgradient from ICPP and since magnesium was not measured in other wells above the federal secondary MCL, this contamination is not likely associated with the ICPP.

5.3.6 Buried Gas Cylinders (Group 6)

Site CPP-94 includes an area about 2.4 km (1.5 mi) northeast of the INTEC along the south side of a dirt security road. Four exposed gas cylinders have been observed at the site and are believed to contain hydrofluoric acid. Site CPP-84 is located outside the INTEC fence line, east of Lincoln Boulevard and south of the Big Lost River. An estimated 40 to 100 cylinders were disposed in a trench at Site CPP-84. The safety hazards associated with CPP-94 and CPP-84 are similar. The potential for cylinder over-pressurization and bursting is considered to be the most serious hazard at both sites. Hydrofluoric acid is very corrosive, reacts violently with moisture, and can generate explosive concentrations of hydrogen gas. Fluoride, a chemical residual of hydrofluoric acid reactions, is a potential health and ecological hazard. No known release of the cylinder contents has occurred. As no sampling activities have been conducted at these sites, no sample results or sampling statistics are available. The buried gas cylinders (Group 6) are considered to contain low-level threat wastes.

5.3.7 SFE-20 Hot Waste Tank System (Group 7)

A preliminary investigation conducted in 1984 indicated that the tank liquid and sludge contain elevated levels of Cs-137, Cs-134, Co-60, Sr-90, and isotopes of europium, plutonium, and uranium. Previous spills within the tank vault and pump pit contained similar contaminants. Site CPP-69, soil contamination is associated with CPP-VES-SFE-20. Soils beneath the tank vault have not been sampled due to inaccessibility. There is no evidence that the vault has leaked. The soils were not included as a source in the vadose zone and groundwater models used for risk assessment. The SFE-20 Hot Waste Tank System (Group 7) is identified as containing principal threat wastes.

In February 1984, liquid and sediment samples were taken from the tank interior, vault floor, and pump pit (Table 5-27). The analysis consisted of only Co-60, Cs-137, Cs-134, Eu-152, Eu-154, Eu-155, Sb-125, total strontium, and plutonium and uranium isotopes. The reported concentrations of Cs-137, total strontium, and plutonium isotopes in the single tank liquid sample were 2,050,000; 9,700,000; and 17,600,000 pCi/L, respectively (WINCO 1984). For the same radionuclides, the concentrations in the tank sediment sample were reported at 55,400,000,000; 4,700,000,000; and 93,500,000 pCi/L, respectively. Three samples were collected from the floor (two liquids and one sediment). The reported concentrations in the two liquid floor samples for Cs-137 (analysis for total strontium and plutonium isotopes was not requested) taken from the south and center vault floor locations were 905,000 and 248,000,000 pCi/L, respectively. The reported concentrations of Cs-137, total strontium, and plutonium isotopes in the sediment sample collected on the north end of the vault were 8,920,000; 1,720,000; and

79,200 pCi/g, respectively. For the same radionuclides, the concentrations in the pump pit sediment sample were 2,290,000; 5,890,000; and 3,010 pCi/g, respectively. Only Cs-137 at a concentration of 76,000 pCi/L was reported for the pump pit liquid sampling (WINCO 1984).

There are no data available for nonradioactive constituents; however, the tank contents may contain inorganic and organic constituents that were associated with the operation of the CPP-603 spent fuel storage pool filtration system. It should be noted that generally, longer lived radionuclides (i.e., those having half-lives greater than 10 years) are of most concern and thus, those with shorter half lives were not summarized in this section.

Table 5-27. Summary analytical results for the SFE-20 hot waste tank system.

	Identification Number and Location	Type	Co-60	Cs-137	Cs-134	Eu-152	Eu-154	Eu-155	Sb-125	Sr	Pu	U*
Radioisotopic content of smears and samples of SFE-20 area (Sample concentration (pCi/smear [sear samples], pCi/g [solids] or pCi/mL [liquids])												
1	Pipes (exteriors) and walls (interior) in pump pit ~ midway between CPP-642 and pit floor.	Smear	—[a]	7.68E+02	—[a]	—[a]	—[a]	—[a]	—[a]	—[b]	—[b]	—[b]
2	Pipes and walls in pump pit 1 to 2 ft from bottom.	Smear	—[a]	8.97E+03	—[a]	—[a]	—[a]	—[a]	—[a]	—[b]	—[b]	—[b]
3	Walls, floor, and ceiling of access tunnel.	Smear	5.54E+01	1.39E+04	5.92E+01	5.84E+02	5.70E+02	1.21E+02	—[a]	—[b]	—[b]	—[b]
4	Representative areas of vault walls.	Smear		2.19E+03								
5	SFE-20 tank (exterior).	Smear	1.51E+00	5.84E+04	9.84E+01	1.20E+03	7.70E+02	2.04E+02	—[a]	—[b]	—[b]	—[b]
7	Areas of apparent seepage on walls.	Smear	9.51E+01	4.16E+04	—[a]	—[a]	—[a]	—[a]	—[a]	—[b]	—[b]	—[b]
8	Floor-south end of vault.	Liquid	5.83E+00	9.05E+02	1.35E+00	—[a]	—[a]	—[a]	—[a]	—[b]	—[b]	—[b]
9	Floor-center section.	Liquid	1.05E+02	2.48E+05	1.55E+00	—[a]	—[a]	—[a]	—[a]	1.71E+05	1.02E+02	<1.60E-04
10	SFE-20 tank interior.	Liquid	7.43E+01	2.05E+03	7.76E+00	—[a]	—[a]	—[a]	7.32E+01	9.70E+03	1.76E+04	<1.60E-04
11	Floor-north end of vault.	Dry Solids	2.15E+04	8.92E+06	1.06E+04	1.50E+05	1.31E+05	4.73E+04	—[a]	1.72E+06	7.92E+04	—[b]
12	Bottom 6 in.-tank interior.	Wet Solids	3.27E+05	5.54E+07	1.62E+05	1.38E+05	1.21E+05	—[a]	—[a]	4.70E+06	9.35E+04	1.91E-03
13	Bottom of pump pit.	Wet Solids	2.38E+04	2.29E+06	1.33E+04	5.65E+04	4.62E+04	2.05E+04	4.73E+04	5.89E+06	3.01E+03	—[b]
14	Pump pit-sump.	Liquid	—[a]	76	—[a]	—[a]	—[a]	—[a]	—[a]	—[b]	—[b]	—[b]

Table 5-27. (continued).

Sample Number	Cs-137	K-40	Ra-226	Th-232	Alpha
Analysis for SFE-20 surface soil samples (Sample concentration [pCi/g])					
1	2.29E+01	1.78E+01	3.22E+00	2.03E+00	5.0E-02
2	4.40E+00	—[a]	3.18E+00	2.80E+00	2.35E+00
3	2.28E+01	—[a]	6.33E+00	2.10E+00	—[c]
4	2.39E+01	3.17E+01	—[c]	—[c]	—[c]
5	3.43E+01	2.91E+01	—[c]	—[c]	—[c]

* The unit of measures for Uranium (U) was reported in g/L.

a. Isotope below detection limit.

b. Analysis was not requested. Decision was based on earlier Alpha Scan results.

c. Analysis not performed. Analyzed only samples expected to show highest concentrations.